NOVOGRUDSKIY, V.N.; FAKIDOV, I.G.

Magnetocaloric effect and the magnetization of ferrimagnetic chromium sulfide. Fiz.met.i metalloved. 9 no.3:332-336 Mr '60. (MIRA 13:6)

1. Institut fiziki metallov AN SSSR.
(Chromium sulfides--Magnetic properties)
(Magnetic fields)

80880

18.8100
18.1235

S/126/60/009/06/004/025
E073/E335

AUTHORS: Margolin, S.D. and Fakidov, I.G.

TITLE: Magnetic Studies of Cr-Ge Alloys

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 6, pp 823 - 827 (USSR)

ABSTRACT: The present work is concerned with the magnetic properties of Cr-Ge alloys with Ge concentration between 50 and 95%, in the temperature region 77 - 320 °K and magnetic fields up to 16 000 Oe. The alloys were prepared from 99.997% pure germanium and high-purity electrolytic chromium degassed in a vacuum at 1 000 °C. Quartz containers charged with the samples of the alloy were heated to 1 100 °C and kept at that temperature for 2 hours. They were then cooled in the furnace down to room temperature. Next, the alloys were gradually heated to 900, 800, 700 and 600 °C and were maintained at these temperatures for 5 hours and subsequently cooled to room temperature in the furnace. Altogether 13 alloys were prepared with Ge concentrations between 50 and 95 at.%. Alloys having a concentration of 70 and 75% were prepared twice in order to compare results. The temperature dependence of

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Magnetic Studies of Cr-Ge Alloys

the magnetisation of the alloys was determined by a ballistic method in fields up to 3 000 Oe, by pulling them out from the measuring coil. The magnetic susceptibility was measured with the aid of a pendulum magnetometer (Domenical, Ref 3) in fields up to 16 000 Oe. Figure 1 shows the temperature dependence of magnetisation I ($gauss/cm^3$) for alloys with different concentrations (as indicated) in a magnetic field of 3 000 Oe. As can be seen, the Cr-Ge alloys have a ferromagnetic transformation temperature between 100 and 110 °K. The maximum values of magnetisation are found for alloys containing 66.6 and 70 at.% of germanium. Figure 2 shows the temperature dependence of the magnetisation of the alloy containing 66.6 at.% of germanium for different fields (as indicated). As can be seen, the ferromagnetic transformation temperature lies between 100 and 110 °K. Figure 3 shows the magnetisation curves for alloys of different germanium concentration (as indicated) at 77 °K. As can be seen, the alloy with 66.6 at.% of germanium has the most rapid increase in the magnetisation with field. Figure 4 shows

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Magnetic Studies of Cr-Ge Alloys

the dependence of the magnetic susceptibility on the germanium concentration at room temperature and in a magnetic field of 13 900 Oe. As can be seen, the maximum susceptibility occurs in the region of 66.6 at.% Ge. Figure 5 shows the temperature dependence of the reciprocal of the susceptibility for an alloy consisting of 33.3 at.% of Cr and 66.6 at.% of Ge in a magnetic field of 10 800 Oe. As can be seen, above 225 °K the Curie-Weiss law:

$$\chi = \frac{C}{T - \Theta_p}$$

is satisfied, where $\Theta_p$ = 142 °K (paramagnetic Curie point). Using these experimental data, it was calculated that the number of Bohr magnetons per chromium atom in an alloy containing 66.6 at.% of Ge is 2.3. Micro-photographs for alloys containing 65, 66.6, 75 and 80 at.% of Ge are shown in Figure 6. The general conclusion is

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Magnetic Studies of Cr-Ge Alloys

that alloys with Ge concentration above 50 at.% have a Curie temperature between 100 and 110 °K and are ferromagnetic between 77 and 110 °K. In these alloys only one phase is ferromagnetic and is very probably close to the chemical compound $CrGe_2$.

There are 6 figures and 3 references, 1 of which is Soviet, 1 German and 1 English.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics of the Ac.Sc.USSR)

SUBMITTED: July 11, 1959, initially;
December 9, 1959, after revision.

4

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FAKidov, I.G.

81912

S/126/60/010/01/019/019
E032/E514

24.7600

AUTHORS: Fakidov, I.G. and Novogrudskiy, V. N.

TITLE: Hall Effect in $MnAu_2$

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.1, pp. 158-160

TEXT: The alloy used in the present work was prepared by a method analogous to that described by Meyer and Taglang in Ref.1. The specimen was in the form of a plate 10.59 x 5.53 x 0.33 mm. Magnetic measurements showed that the specimen has a Neel temperature of 92°C. The Hall e.m.f. was measured with the aid of a low resistance potentiometer working in conjunction with the galvanometer having a sensitivity of $2 \times 10^{-8}$ V/mm. The magnetic measurements were carried out using a pendulum magnetometer described by Dominicall (Ref.4). Fig.1 shows the dependence of the Hall e.m.f. on the external magnetic field at room temperature (curve 1) and at 96°C (curve 2). As can be seen from curve 1, the dependence of the Hall potential difference on the field is linear in the antiferromagnetic region. In the transition of $MnAu_2$ into the ferromagnetic state, the Hall e.m.f. increases and

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Hall Effect in $MnAu_2$

the dependence on the magnetic field is no longer linear. The linear form of the Hall e.m.f. curve, which is obtained above the Neel point, is preserved even when the external magnetic field is higher than 8 kOe. Unfortunately, owing to the large demagnetization factor of the plate and the lack of really high fields (of the order of 35 to 40 kOe), the measurements could not be extended to the saturation region. As can be seen from Fig.1, the Hall e.m.f. is noticeably dependent on temperature and for H = 5 kOe (i.e. in the antiferromagnetic region), the Hall e.m.f. increases by a factor of 2 when the temperature is altered from 18 to 96°C. In the ferromagnetic region this temperature dependence is weaker. Fig.2 shows the dependence of the Hall e.m.f. on the magnetization at 18°C. This plot consists of two straight lines at a definite angle to each other. It is concluded that in the transition of the specimen into the ferromagnetic state there is an alteration in the mechanism responsible for the Hall effect. Further work is continuing on the galvanomagnetic properties of $MnAu_2$. There are 2 figures and 5 references, 1 of which is Soviet,

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81912

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E032/E514

Hall Effect in $MnAu_2$

2 French and 2 English.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals, AS, USSR)

SUBMITTED: February 18, 1960

Card 3/3

ZAVADSKIY, E.A.; FAKIDOV, I.G.

Electric conductivity of n-type germanium in strong magnetic fields. Fiz. met. i metalloved. 10 no.3:495-496 S '60. (MIRA 13:10)

1. Institut fiziki metallov AN SSSR.
(Germanium--Electric properties) (Magnetic fields)

85038

S/126/60/010/004/006/023
E201/E491

9,4300 (1137, 1138, 1143)

AUTHORS: Samokhvalov, A.A., Fakidov, I.G. and Kopytov, Ye.I.

TITLE: The Anomaly of Very-High-Frequency Permittivity of Antiferromagnetic Semiconductors at the Néel Temperature

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol.10, No.4, pp.538-542

TEXT: A waveguide method was used at 9500 Mc/s to study the permittivity anomaly of $Cr_2O_3$ at the Néel temperature of 33 to 37°C. $Cr_2O_3$ is an antiferromagnetic semiconductor with very low electrical conductivity ($10^{-9}$ - $10^{-14}$ $ohm^{-1}$ $cm^{-1}$) at room temperature. Its forbidden bandwidth depends on many factors and ranges from 0.4 to 0.8 eV; on transition through the Néel point the activation energy jumps by 0.08 eV. Samples were made from $Cr_2O_3$ powders of ЧДА (ChDA) purity by pressing (5000 $kg/cm^2$) and subsequent firing at 800 to 900°C. Before measurement the samples were dried by vacuum heating at 400°C. The circuit used in measurements is shown in a figure on p.540. A klystron oscillator of 51-И (51-I) type was used as the source. A standard waveguide line, with an indicator making it possible to measure the standing-wave minimum to within 0.01 mm, was employed. The signal was passed to a narrow-

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The Anomaly of Very-High-Frequency Permittivity of Antiferromagnetic Semiconductors at the Néel Temperature

band amplifier of 21-ИМ (21-IM) type or to a ГПЗ-2 (GPZ-2) galvanometer. Both the amplifier and the klystron oscillator had stabilized power supplies. Permittivity was measured with an additional waveguide section ( 1 in the figure) insulated from the main waveguide by a thin mica plate. A sample was heated with an oven ( 2 in the figure) and its temperature was measured with a copper-constantan thermocouple ( 5 ). The sample ( 4 ) was placed at the short-circuited end of the section 1 or at a quarter-wavelength from the short-circuited end, i.e. in the open-circuit position. Complex permittivity was found from displacement of the standing-wave minimum and from measurements of the standing-wave ratio, deduced from the width of the standing-wave minimum. It was found that on transition to the paramagnetic state the real component of permittivity increased discontinuously by 3 to 4%. This jump may affect markedly the changes of the energy spectrum on destruction of the antiferromagnetic spin order at the Néel temperature. The authors point out that similar permittivity jumps were observed in other antiferromagnetics such as MnS, FeO etc. The authors

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E201/E491

The Anomaly of Very-High-Frequency Permittivity of Antiferromagnetic Semiconductors at the Néel Temperature

measured also the dispersion of permittivity between 100 and $10^8$ c/s: permittivity was $16 \pm 1$ at 100 c/s, decreasing monotonically with frequency and reaching $3.8 \pm 0.3$ near $10^8$ c/s. (The latter was the value obtained at 9500 Mc/s and 20°C.) There are 1 figure and 12 references: 2 Soviet, 6 English, 3 French and 1 translation from English into Russian.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute for Metal Physics, AS USSR)

SUBMITTED: March 9, 1960

Card 3/3

83166

S/056/60/039/002/003/044
B006/B056

24.2200

AUTHORS: Krasovskiy, V. P., Fakidov, I. G.

TITLE: The Magneto-caloric Effect Within the Range of Low-temperature Transformation of Magnetite

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 2 (8), pp. 235-241

TEXT: The present paper makes a contribution towards explaining the nature of the low-temperature transformation of magnetite. The authors investigated the particular features of the magneto-caloric effect in this temperature range, as well as the temperature dependence of the first anisotropy constant. The investigations were carried out with two spherical magnetite single crystals of different stoichometric composition and two different potentiometric devices having a sensitivity of $\sim 10^{-8}$ v/mm. The experimental arrangement and the performance of the experiments are described first; they were the same for both of the samples. The samples were demagnetized at room

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The Magneto-caloric Effect Within the Range of Low-temperature Transformation of Magnetite

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B006/B056

temperature, after which they were cooled to the boiling point of liquid nitrogen (without magnetic field). The temperature dependence of the magneto-caloric effect was studied while the samples were heated in a Dewar. Next, also the effect of the cooling conditions in the presence of a magnetic field of different strength upon the magnitude of the effect was investigated. Within the transformation range, the dependence of the magnitude of the effect $\Delta T$ on the field strength was measured; the measurements began at the lowest and extended up to the highest field strength. At low field strengths, magnetite has jumps in the magnetization I. The I(T)-measurements carried out in the range from 85° to 125°K showed that already at 15,000 oersteds no jumps occur any longer. In all cases $\vec{H}$ was parallel to the [111] direction of the single crystals. The absolute error in measurement of $\Delta T$ was about $2.10^{-3}$°K. Fig. 1 shows $\Delta T = f(T)$ for both samples when heated (the samples had previously been demagnetized at room temperature and had been cooled to 80°K without a magnetic field). The curves had been drawn at 13,800 and 17,000 oe, respectively. They are in the negative range, first show a

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steep decline, have a sharp minimum at 104° and 110°K, respectively, after which they rise just as steeply, and cut the zero axis at 145° and 125°K, respectively. In the positive range, $\Delta T$ slowly increases linearly with T. In the range of these minima of the curves, an "effect of the first measurement" could be observed (the first application of the field led to an irreversible temperature drop, and $\Delta T$ was about double as large as in the following experiments). Outside the range 95 - 115°K this effect practically does not exist at all. Fig. 2 shows the temperature dependence of the reversible magneto-caloric effect in the range of the minima. $\Delta T = f(H)$ is shown in Fig. 3 (recorded at 109.6°K). In fields up to 3000 oe, $\Delta T$ is positive, but attains only about 0.01°K. The sharp minimum of the temperature dependence of the magneto-caloric effect is related with a low-temperature transformation of magnetite in which the crystallographic symmetry of the lattice changes. Sample No. 2 showed a second minimum at about 90°K, which was, however, very flat; within this range, sample No. 1 only showed a greater spread of measured values; it is, however, possible that by means of more

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The Magneto-caloric Effect Within the Range of Low-temperature Transformation of Magnetite

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sensitive measuring instruments a minimum would be found also in this case. The temperature dependence of the first derivative of the anisotropy constant of sample No. 2 is shown in Fig. 4. It turned out that below the transformation point (110°K) the magnetite lattice is not cubic but rhombohedral. N. S. Akulov and N. L. Bryukhatov are mentioned. There are 4 figures and 16 references: 6 Soviet, 2 British, 6 US, 1 Dutch, and 1 Japanese.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals of the Academy of Sciences of the USSR)

SUBMITTED: February 19, 1960 (initially) and April 11, 1960 (after revision)

84385

S/056/60/039/004/003/048
B004/B070

24.7900 (1035, 1144, 1160)

AUTHORS: Gaydukov, L. G., Grazhdankina, N. P., Fakidov, I. G.

TITLE: Investigation of the Temperature Dependence of Spontaneous Magnetization of Chromium Telluride

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960, Vol. 39, No. 4(10), pp. 917-922

TEXT: The aim of the authors was to find out whether chromium telluride is ferromagnetic or ferrimagnetic. For this purpose, the temperature dependence of the spontaneous magnetization $\sigma_s$ was investigated in the neighborhood of the Curie point. The chromium telluride was prepared by melting together powders of chromium and tellurium. Fig. 1 shows the magnetocaloric effect $\Delta T$ as a function of $\sigma^2$. $\sigma_s^2$ was obtained by extrapolating to T = 0. Fig. 2 shows $H_i/\sigma = f(\sigma^2)$. $\sigma_s^2 = -\alpha/\beta$ was obtained from $\alpha\sigma + \beta\sigma^3 = H$ (1), and was found to be in good agreement with the experimental data. In the temperature range $|T - \theta_f| \leqslant 14.5^\circ C$, $\alpha$ is a

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Investigation of the Temperature Dependence of Spontaneous Magnetization of Chromium Telluride

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linear function of temperature: $d\alpha/dT = 40$, while $\beta$ remains almost constant and lies between 1 and 0.8. The Curie temperature determined from the condition $\alpha = 0$ is 60°C; this is somewhat higher than that determined from the magnetocaloric effect (55°C), from the temperature dependence of the electrical resistance (57.5°C), and from the maximum of the galvanomagnetic effect (58.0°C). $\sigma_s$ obtained by the three methods are compared in Fig. 3. The results agree well with each other in the range $T < \theta_f$. The rate of change of the spontaneous polarization of CrTe brought about by temperature was determined from equation (2): $(\sigma_s/\sigma_o)^2 = \{(1 - T/\theta_f) \cdot \{$ was found to be 2.40 - 2.46 (Fig. 4). In the paramagnetic region, the magnetic susceptibility obeys the Curie - Weiss law $\chi = C_M(T - \theta)$, where $C_M = 1.97$, and $\theta = 347°K$. The authors interpret the results by means of the s - d exchange model of ferromagnetism. Pending a final decision by means of a neutronographic investigation, the authors come to the conclusion that CrTe is not ferrimagnetic but ferromagnetic which is characterized by weak s - d exchange interaction.

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Investigation of the Temperature Dependence of Spontaneous Magnetization of Chromium Telluride

S/056/60/039/004/003/048
B004/B070

Among others, the authors mention V. P. Krasovskiy, K. P. Belov, A. Z. Men'shikov, S. A. Nemnonov, S. V. Vonsovskiy, A. K. Kikoin, and K. B. Vlasov. There are 4 figures and 17 references: 8 Soviet, 2 US, 1 Canadian, 4 French, 1 German, and 1 Japanese.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of the Physics of Metals, Academy of Sciences, USSR).
Sverdlovskiy gosudarstvennyy pedagogicheskiy institut (Sverdlovsk State Pedagogical Institute)

SUBMITTED: April 27, 1960

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FAKIDOV, I.G.

1

35011
S/596/61/000/000/001/003
D217/D304

1.8000

AUTHORS: Buzynov, A.Ye., Yekhlakov, A.D., Motova, Z.A., Mochalov, M.D., and Pakidov, I.G.

TITLE: Action of γ-irradiation from the betatron on X-ray films, and the constitution of exposure graphs of irradiated steel

SOURCE: Akademiya nauk SSSR. Institut fiziki metallov. Betatronnaya gamma-defektoskopiya stali. Moscow, 1961, 10 - 25

TEXT: A sensitometric investigation of the action of γ-rays on several types of films was studied and the distribution of the intensity of irradiation along the cross section of the beam was measured. German films made by Agfa (GDR), Laue, Sino, Texo-R, Texo-S and the high sensitivity Russian films of factory no. 8, "Rentgen-X-opytnyy" and "Rentgen-X-opytnyy" sprayed from one side, were investigated. From the sensitometric results obtained, exposure graphs were plotted. These, in conjunction with curves for the angular distribution of intensity and figures illustrating the dependence of

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Action of γ-irradiation from ...

exposure-time of defects on the degree of blackening of the film, enabled the exposures under various conditions of X-raying to be calculated. It was found, that the experimental film "Rentgen-X" sprayed on both sides, was the most sensitive one with respect to γ-rays from the betatron. The German films Agfa, Laue, Agfa Sine and Agfa Texo-R have similar sensitivity characteristics under similar conditions. The film Texo-S is somewhat less sensitive. Intensifying screens considerably shorten the time of exposure. The 1 and 2 mm front lead screens differ little from each other as to their action on the film. With an increase in thickness of the irradiated steel plates, the conventional characteristic curves of the films are displaced in the direction of increasing exposure and change their general character, the linear portion of the curve decreasing in extent. The contrast range also changes somewhat. All imported films, when used in conjunction with the betatron, should receive longer exposures than those indicated by the manufacturer. Curves were constructed for the dependence of the degree of blackening of the film on the distance from the center of the beam, for various exposures in the center of the field of irradiation and for

Action of γ-irradiation from ...

steel plates of various thicknesses (50 - 426 mm). Exposure graphs for the Agfa Texo-R film were constructed for several degrees of blackening. Graphs were constructed for two sets of screens, used respectively for the determination of small defects (pores, cracks etc.) and for big casting defects. There are 13 figures, 4 tables and 19 references: 7 Soviet-bloc and 12 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: A.L. Pace, Non-destructive testing, 12, 1954, no. 2, 21; R. Widerøe, Non-destructive testing, 11, 1953, no. 4, 23; C.E. Juran, Non-destructive testing, 11, 1953, no. 8, 25; K. Nelson, Journal Sci. Instr., 33, 1956, no. 1.

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ORLOV, A.N., otv. red.; FAKIDOV, I.G., otv. red.; YAKOBSON, A.M., red. izd-va; RYLINA, Yu.V., tekhn. red.

[Betatron gamma defectoscopy of steel] Betatronnaia gamma-defektoskopiia stali. Moskva, Izd-vo Akad.nauk SSSR, 1961. 56 p. (MIRA 14:11)

1. Akademiya nauk SSSR. Institut fiziki metallov.
(Steel--Testing) (Gamma rays--Industrial applications)

S/263/62/000/017/011/011
I011/I211

AUTHORS: Buzynov, A. Ye, Yekhlakov, A. D., Motova, Z. A., Mochalov, M D. and Fakidov, I G

TITLE: The effect of a betatron γ-radiation on X-ray films and compilation of exposition graphs for the radioscopy of steel

PERIODICAL: Referativnyy zhurnal. Otdel'nyy vypusk, Izmeritel'naya tekhnika, no 17, 1962, 61, abstract 32.17.417. Collection "Betatromaya gamma-defektoskopiya stali" M., AN SSSR, 1961, 10-25

TEXT: A sensitometric investigation of the effect of betatron radiation on different films was carried out and the radiarion intensity distribution in the ray cross-section was measured. The Agfa company (GDR) Lane, Sino, Texo-R, Texo-S films and the high-sensitivity home films of factory No. 8: "rentgen-X-opytnyy" and "rentgen-X-opytnyy" with one sided glaze were investigated. The sensitometric film parameters were investigated in direct exposition to the betatron radiation as well as in expositions behind steel plates of different thickness. The results of the investigations are discussed and exposition graphs are constructed on the basis of the sensitometric data obtained. An example of exposition calculation is given. It is shown that the most sensitive to the betatron γ-radiation film is the experimental "rentgen"-X with 2-sided glaze. There are 13 figures. Bibliography: 19 titles.

[Abstracter's note Complete translation.]

Card 1/1

35012
S/596/61/000/000/002/003
D217/D304

1,8000

AUTHORS: Buzynov, A.Ye., Yekhlakov, A.D., Mochalov, M.D., and Fakidov, I.G.

TITLE: Experimental determination of the sensitivity of the photo-radiographic method of non-destructive testing by γ-irradiation and by irradiation from a betatron of 22 Mev.

SOURCE: Akademiya nauk SSSR. Institut fiziki metallov. Betatronnaya gamma-defektoskopiya stali. Moscow, 1961, 30 - 35

TEXT: The authors experimented with the models of defects in the form of cylindrical holes with fairly big diameters (10 mm), so that the degree of diffuseness of the edge was considerably less than the radius of the hole. The sensitivity was determined for defects of various depths $\Delta L$, measured along the beam, and for various total thicknesses of irradiated plates L. The difference in thickness between sound and faulty places was of relatively little

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Experimental determination of the ...

significance, owing to the small size of the defects. It can, therefore, be assumed that changes in the characteristic curves of the film used would be insignificant for variations in thickness of this order. A graduated non-destructive testing machine was specially made for the investigation. The apparatus was made in the form of eight segments of a disc, each differing from the preceding one in thickness by 1 mm (except for the first and eigth, which differed from each other by 7 mm). An annular hole of radius 4 cm was drilled through the eight segments; the center of the annulus coincided with that of the disc, and the diameter of the hole was 10 mm. The holes and steps were intended to simulate defects of definite dimensions. The apparatus was placed in front of the irradiated steel plates, and orientated so that its center should coincide with the axis of the betatron beam. Under these conditions, the defects received $\gamma$-rays of equal intensity, and shadow images thereof were arranged along the circumference of the film. For exposure, an Agfa Texo-R film, 15 x 20 cm, was placed between the intensifying screens. In order to minimize the dispersed background radiation, a lead screen, 3 mm thick, was placed behind the rear fluorescent screen,

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and a lead screen, 25 mm thick, was placed behind the adaptor. Steel plates of various thicknesses were used as specimens for irradiation. It was found that the relative sensitivity of the radiographic method of betatron testing increases with increase in thickness of the steel plates. The dependence of the magnitude of the smallest detectable defect on the thickness of the irradiated steel plates was established. The size of the smallest detectable defect depends on the thickness and combination of intensifying screens. There are 8 figures and 10 references: 1 Soviet-bloc and 9 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: H. Crainer, Non-destructive testing, 15, 1957, no. 4, 234; R. Widerøe, Non-destructive testing, 12, 1954 no. 4, 27; A.L. Pace, Non-destructive testing, 12, 1954, no. 2, 21; E.A. Burril, Non-destructive testing 11, 1952, no. 2, 23.

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24905 S/181/61/003/006/002/031
B102/B201

247600

AUTHORS: Davidenko, N.I., Samokhvalov, A.A., and Fakidov, I.G.

TITLE: Anisotropy of the longitudinal thermomagnetic Nernst-Ettingshausen-effect in magnetite in the low-temperature transition region

PERIODICAL: Fizika tverdogo tela, v. 3, no. 6, 1961, 1650 - 1653

TEXT: The crystal structure of magnetite is modified at about 120°K, and, as a consequence, all physical properties are practically changed. In connection with the theory by Verwey et al. (J. Chem. Phys. 15, 181, 1947), in which the 3d electrons are assumed to rearrange in the transition point, it is of interest to study the anisotropy of various properties of magnetite, as it may serve to verify the theory. The authors studied the anisotropy of the longitudinal thermomagnetic Nernst-Ettingshausen effect (l.th. N-E.E.) in the transverse magnetic field. A report is given of relative results. For measuring the l.th.N-E.E., the sample was introduced into a cryostat cooled with liquid nitrogen.

Anisotropy of the longitudinal...

By two heaters at the sample ends, it was possible to establish any temperatures between 77 and 200°K. Two copper-constantan thermocouples served for measuring the temperature. The samples were cut from natural magnetite single crystals and had a cylindrical shape (3 mm in diameter, 10-15 mm long) with the axis parallel to the [110] direction (the orientation was checked roentgenographically). Temperature gradient and direction of the measurement of the 1.th.N-E.E. likewise coincided with the [110] direction. The constant magnetic field of 20,400 oe was in the (110) plane, perpendicular to [110]. During the measurement of the 1.th.N-E.E. the samples were rotated about the axis by 360°, first in one, then in the opposite direction, and a measurement was made every 10°. The mean values were then calculated from four measured values at each point. The anisotropy of the 1.th.N-E.E. was measured on five samples in the 90 - 160°K range. Fig. 1 presents the 1.th.N-E.E. as a function of the orientation of the magnetization vector with respect to the [001] direction; the relative change of the thermo-emf in the magnetic field, which is related to the value of the 1.th.N-E.E. by the relation $\Delta\alpha/\alpha = E_{N\text{-}E.}/(\alpha\Delta T/\Delta x)$, is taken as the ordinate. The study

Anisotropy of the longitudinal....

yielded the following results: 1) If the magnetite is cooled below the transition point, not only the value of the 1.th.N-E.E. changes, but to a high degree also the character of anisotropy. If the magnetic field is parallel to the [1$\bar{1}$0] direction, a maximum change of the effect will be observed both above and below the transition region. 2) The 1.th. N-E.E. has, below the transition point, and if the magnetic field is applied in parallel to the [110] direction, a considerable value to which corresponds a diminution of the thermo-emf in the magnetic field by 14 %. 3) The irreversible part of the first anisotropy curve that may be observed with samples cooled down to liquid-nitrogen temperatures without magnetic field, is connected with the irreversible re-orientation of the orthorhombic c-axes of the various domains in the strong magnetic field.There are 2 figures and 10 references: 1 Soviet-bloc,and 9 non-Soviet-bloc. The three most important references to English-language publications read as follows: S.C.Abrahams, V.A.Calhoun. Acta Cryst.8, 257,1955; W.C.Hamilton.Phys.Rev.110, 1050, 1958; C.A.Domeniciali.Phys.Rev.78, 458, 1950.

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24905

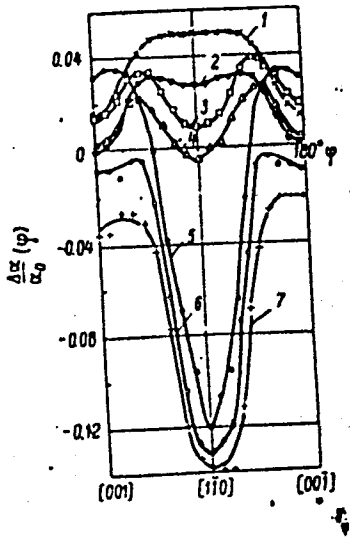
S/181/61/003/006/002/031
B102/B201

Anisotropy of the longitudinal....

ASSOCIATION: Institut fiziki metallov AN SSSR Sverdlovsk (Institute of Physics of Metals AS USSR Sverdlovsk)

SUBMITTED: December 12, 1960

Legend to Fig. 1: 1) 124°K,
2) 113,
3) 110,
4) 108,
5) 96,
6) 92,
7) 91°K.




Card 4/4

DAVIDENKO, N.I.; FAKIDOV, I.G.

Anisotropy of the longitudinal thermomagnetic Nernst-Ettinghausen effect in magnetite in the region of low-temperature transformation. Fiz.tver.tela 3 no.10:3197-3206 O '61. (MIRA 14:10)

1. Institut fiziki metallov AN SSSR, Sverdlovsk.
(Thermomagnetism)

S/181/61/003/011/005/056
B102/B138

24.7600 (1043, 1137, 1164)

AUTHORS: Novogrudskiy, V. N., and Fakidov, I. G.

TITLE: Hall effect in the metamagnetic compound $MnAu_2$

PERIODICAL: Fizika tverdogo tela, v. 3, no.11, 1961, 3278-3284

TEXT: The authors continued earlier studies (FMM, 10, 158, 1960; ZhETF, 40, 1, 1960) and measured Hall e. m. f. in $MnAu_2$ specimens by means of a low-resistance voltmeter and a sensitive galvanometer. The Neel point of the specimens was at 92°C, the threshold field strength was 8000 oe at 20°C. Measurements were made with two field and current directions in order to eliminate side effects. Magnetization was found to increase with H in a temperature-dependent manner. At 18.5°C $\sigma(H)$ is an S-shaped curve (slight increase up to 10 oe, steep increase between 10 and 15 oe, and then slight increase again), at 81°C it is more flat and crosses the $\sigma(H)$ curve for 96°C at about 8 oe. $\sigma(H)$ at 96°C forms a straight line. The Hall e.

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Hall effect in the metamagnetic compound ...

m. f. was measured as a function of H between -196 and + 110°C. The curves are almost straight lines, the gradients, which become steeper with rising temperature up to the Neel point. At higher temperatures the gradient is reduced again. Investigation of the temperature dependence of the Hall e. m. f. showed that the curves have rather broad maxima at the Neel point. I. K. Kikoin (Sow. Phys. 1, 9, 1936) has shown that for strong paramagnetics and for ferromagnetics above Curie point, the Hall e. m. f. $E_H = R_o(1+4\pi\chi)HI/d$. I is the current intensity in the specimen, d its thickness, $\chi$ the magnetic susceptibility and $R_o$ the usual Hall constant. This holds with good accuracy also for the $MnAu_2$ specimens if $R_o$ and $\alpha$ are taken as $2.19 \cdot 10^{-12}$ v·cm/a·oe and 8.8, respectively. These values were determined from measurements in the paramagnetic temperature range. In order to find out if not only magnetic ordering but also the Hall constant changes when passing the threshold field strenght, $E_H$ was measured as a function of magnetization. The curve shows a break at threshold field strength. The $\sigma$-dependence of $E_\chi - R_o H$, however, forms almost a straight

line, the change in direction at threshold field strength is so little that it lies within measurement error limits. This shows that both parts of Hall effect have to be taken into account. Conclusions: Comparison of $E_H(t)$ in the paramagnetic and antiferromagnetic temperature ranges shows together with the $E_H(\sigma)$ measurements, that $MnAu_2$ has, as a further Hall e. m. f., in addition to the normal one. It can be assumed that this e. m. f. is caused by magnetization and that the Hall constant responsible for this part of the effect increases with temperature. The temperature dependence of the Hall potential difference in $MnAu_2$ below threshold field strength is very different from that in antiferromagnetics such as Cr or MnTe. It is not certain whether $\sigma$ changes when passing through the threshold field, but the effective fields were found to be very close to one other in these two states. There are 4 figures, 1 table, and 13 references: 3 Soviet and 10 non-Soviet. The three most recent references to English-language publications read as follows: I. H. Smith, R. Street. Proc. Phys. Soc., 70, 1089, 1957. C. A. Dominionalli. Rev. Sci. Instr., 21, 327, 1958. E. M. Pugh. Phys. Rev., 97, 647, 1955.

30773
S/181/61/003/011/005/056
B102/B138

Hall effec in the metamagnetic compound ...

ASSOCIATION: Institut fiziki metallov AN SSSR [illegible] (Institute of Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: May 9, 1961

Card 4/4

S/126/61/011/001/015/019
E032/E314

9.4300 (1043, 1143, 1150)

AUTHORS: Zavadskiy, E.A. and Fakidov, I.G.

TITLE: Electrical Conductivity of n-Ge in Strong Pulsed Magnetic Fields

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol. 11, No. 1, pp. 145 - 147

TEXT: In a previous paper the authors showed that the relative change in the resistance of n-Ge reaches a saturation value in a strong longitudinal magnetic field, and beginning at a certain value of the field commences to increase linearly. These results are in agreement with the theoretical predictions of Tsidil'kovskiy and Shirokovskiy (Ref. 2) and Gold and Roth (Ref. 3). The present work is concerned with the variation in the resistivity in a strong transverse magnetic field. n-Ge monocrystalline specimens having resistivities of 2, 30 and 46 ohm.cm at room temperature were used. The specimen dimensions were 9 x 1.5 x 0.8 mm. Current leads covering end surfaces and voltage probes 3.5 mm apart

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S/126/61/011/001/015/019
E032/E314

Electrical Conductivity of n-Ge in Strong Pulsed Magnetic Fields

were used. The contacts were ohmic and the measurements were carried out as in Ref. 1. Fig. 1 shows the relative change in the resistivity for the specimen with $\varrho$ = 2 ohm.cm at different temperatures as a function of the magnetic field (in kOe). The results refer to the case $H \| [111]$. In this specimen the mobility of current carriers was $u = 3500\ cm^2/Vsec$ so that at $H = 2000$ $uH/c \approx 7.0$. Saturation would be expected to set in at $uH/c = 1$. The quantity $(\Delta\varrho_\perp/\varrho_o)_{sat}$ for $H \| [111]$ can be calculated from the formula:

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$$\left(\frac{\Delta\rho_\perp}{\rho_o}\right)_{sat} = \frac{(2\gamma + 1)(4\gamma + 5)}{3\gamma(\gamma + 8)} - 1$$

given in Ref. 2, where $\gamma = m_\ell / m_t$ and $m_\ell$ and $m_t$ are the longitudinal and transverse effective masses. Assuming that $\gamma = 17$, one finds that $(\Delta\rho_\perp / \rho_o)_{sat} = 1.0$. However, complete saturation is not observed. Continuous approach to saturation is, in fact, replaced by a linear increase. A "discontinuity" in the curve is nevertheless observed at $(\Delta\rho_\perp / \rho_o) = 1.2$, i.e. the discontinuity occurs close to the theoretical value of $(\Delta\rho_\perp / \rho_o)_{sat}$. The "discontinuity" can apparently be explained by the quantisation of the energy of the current carriers in the magnetic field which becomes appreciable for $hw \gtrsim kT$ where $w$ is the cyclotron frequency and $h$ is the Planck constant divided by $2\pi$. Assuming that

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Electrical Conductivity of n-Ge in Strong Pulsed Magnetic Fields

the effective mass $m^* = 0.08\ m_o$, one finds that $\omega\tau = kT$ will occur for H = 35 kOe and T = 58 °K, while at T = 77 °K the magnetic field should be 45 kOe. It is clear from Fig. 1 that the "discontinuity" does in fact occur at magnetic fields close to those for which $\omega\tau = kT$. According to Argyres (Ref. 4), the linear relation between $(\Delta\rho_\perp/\rho_o)$ and H should occur in non-degenerate semiconductors when $\omega\tau > kT$ and scattering on phonons terminates. For specimens having resistivities of 2 ohm.cm or greater, scattering on impurity ions can dominate only below 20 °K. Thus the present results are in good agreement with those reported in Ref. 4. Fig. 2 shows the plot of $(\Delta\rho_\perp/\rho_o)$ as a function of H(kOe) for the specimen with $\rho$ = 30 ohm.cm. In this figure H $\parallel$ [110]. A sharp transition to the linear law is found to occur at T = 58 and 77 °K when $(\Delta\rho_\perp/\rho_o) = 2.9$, which is close to the calculated value $(\Delta\rho_\perp/\rho_o) = 3.3$. The latter value

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Electrical Conductivity of n-Ge in Strong Pulsed Magnetic Fields

was obtained for $\gamma = 17$ from the formula given by Gold and Roth in Ref. 3. The "discontinuity" disappears at high temperatures in weak magnetic fields (up to 18 kOe). The results obtained by the present authors at $T = 94\ ^{o}K$ are in good agreement with those reported by Herring et al (Ref. 5). The resistivity of some specimens was also measured at $T = 20\ ^{o}K$. In the case of specimens with $\rho = 30$ ohm.cm with $H \parallel [111]$, the curves of $(\Delta\rho_{\perp}/\rho_{o})$ versus H exhibit the following behaviour: 1) for fields up to 15 kOe the curves approach saturation at $(\Delta\rho_{\perp}/\rho_{o}) = 3.0$; 2) between 35 kOe and 110 kOe the curve is linear and $(\Delta\rho_{\perp}/\rho_{o})$ increases from 4 to 20; 3) above 110 kOe the curve becomes nonlinear and the values of $(\Delta\rho_{\perp}/\rho_{o})$ are 25, 29.5 and 31.5 at 140, 170 and 200 kOe, respectively. The Hall effect has also been measured and the results will be reported in the next paper of the present journal.

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89947

S/126/61/011/001/015/019
E032/E314

**Electrical Conductivity of n-Ge in Strong Pulsed Magnetic Fields**

There are 2 figures and 6 references: 3 Soviet and 3 non-Soviet.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals of the AS USSR)

SUBMITTED: July 20, 1960

Card 6/6

89948

S/126/61/011/001/016/019
E032/E314

9.4300 (1043, 1143, 1158)

AUTHORS: Zavadskiy, E.A. and Fakidov, I.G.

TITLE: Measurement of the Hall Effect of n-Ge in Strong Pulsed Magnetic Fields

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol. 11, No. 1, pp. 147 - 149

TEXT: This paper is a continuation of the previous paper in this issue (pp. 145 - 147).
In earlier papers the authors showed that at sufficiently low temperatures (60-90 °K) the effect of the quantisation of energy of current carriers on the electrical conductivity becomes appreciable for magnetic fields of 50-100 kOe. The aim of the present paper was to elucidate the effect of this quantisation on the Hall constant. Plates (9 x 1.5 x 0.8 mm) cut from n-Ge with ρ = 2, 8.5 and 30 ohm.cm at room temperature were employed. The Hall e.m.f. was exhibited directly on a CRO screen as a function of the magnetic field. The measurements were carried out for different current directions through the specimen and different magnetic-field

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Measurement of the Hall Effect of n-Ge ....

directions. In the temperature range 58 to 310 °K fields up to 200 kOe were used. In addition, the Hall effect was measured at 77 °K in fields up to 450-500 kOe but the Hall constant was found to be independent of the magnetic field. The quantisation of the energy of the carriers in a magnetic field becomes effective for $\hbar\omega > kT$ where $\omega$ is the cyclotron frequency and $\hbar$ is the Planck constant divided by $2\pi$. Assuming that the mean value of the effective mass of the carriers is $m^* = 0.12\ m_o$, one finds that with T = 77 °K the condition $\hbar\omega = kT$ is already satisfied at H = 69 kOe and, consequently, at H = 500 kOe and T = 77 °K one finds that $\hbar\omega = 7\ kT$. The absence of the field dependence of the Hall constant in this case is in disagreement with the predictions of Klinger and Voronyuk (Ref. 3) but is in agreement with the results of Argyres (Ref. 5). Fig. 1 shows the dependence of the Hall e.m.f. (V) on the magnetic field (kOe) for an n-Ge specimen

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Measurement of the Hall Effect of n-Ge .....

with $\rho$ = 30 ohm.cm at T = 20 °K (Curve 1 corresponds to a current density of 7.5 mA/mm$^2$, Curve 2 to 2.5 mA/mm$^2$). The specimen for which Curve 1 was obtained was previously used in measurements of the resistivity and a consideration of the data obtained for it shows that in the region where the Hall constant is variable Ohm's law ceases to hold. This is confirmed by the second curve (Curve 2). Curve 1 was used to calculate the current carrier concentration as a function of the magnetic field and this is shown in Fig. 2. As can be seen from Fig. 2, different values of the current density correspond to different values of the magnetic field at which the change in the carrier concentration begins; thus, the observed changes in the carrier concentration are closely associated with departures from Ohm's law. In the specimen with $\rho$ = 30 ohm.cm at T = 20 °K scattering on impurity ions is still very small. Further work is being carried out on

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E032/E314

Measurement of the Hall Effect of n-Ge ....

the Hall effect using specimens with considerably lower resistivities. There are 2 figures and 5 references: 3 Soviet and 2 non-Soviet.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, AS USSR)

SUBMITTED: July 20, 1960

Card 4/4

S/126/61/011/002/025/025
E073/E535

24.2200 1134, 1138, 1160
1137, 1147, 1158

AUTHORS: Krasovskiy, V. P. and Fakidov, I. G.

TITLE: On the Nature of the Magnetic Ordering of MnP

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.2, pp. 319-320

TEXT: On the basis of earlier work the authors express a certain hypothesis on the nature of the magnetic ordering of MnP. The crystal lattice of MnP presents to some extent a distorted NiAs structure of the type with a rhombohedric elementary cell. Comparison of the crystal structure of MnP with the NiAs type structure is shown in the figure, where the circles of the larger diameter represent projections of atoms of P and Mn, the circles of the small diameter represent projections of atoms of the undistorted NiAs type structure. The top part of the figure shows a projection onto the plane (001), the lower part shows a projection onto the plane (010). The manganese atoms are not located on a straight line and form zigzag chains that are parallel to the axis b and the P atoms form chains that are parallel to the axis c. The axis b corresponds to the hexagonal axis c, whilst the axis c

corresponds to the axis a of the structure NiAs in hexagonal representation. As regards the character of distribution of the atoms, the crystal lattice MnP is similar to the lattice of orthoferrites with a structure of the pseudo-perovskite type (space group $D_{2h}^{16}$ - $Pb_{nm}$). The presence of such a structure permits distribution of magnetic moments that differ from the strictly parallel or antiparallel distribution, i.e. "angular" distribution of the magnetic atoms of the near neighbours is possible (the nearest "neighbours" in the illustration are at a distance of 2.69 Å from each other). In presence of a relatively crystalline magnetic anisotropy, which apparently takes place in MnP (Ref.4), the possibility arises that the vectors of the magnetic moments will deviate from their planes and will be located at some (small) angle relative to each other (in accordance with the model of weak ferromagnetism proposed by I. Y. Dzyaloshinskiy (Ref.5). As a result, a spontaneous magnetic moment will arise which differs from zero and represents the vector sum of the magnetic moments of adjacent atoms. Since the electron states of the manganese atoms in the MnP compound are not known, the absolute values of the magnetic moments of the

adjacent atoms are also not known. "Angular" distribution of the magnetic moments would permit elucidating the great difference between the magnitudes of the moments calculated for a manganese atom and those obtained from susceptibility measurements (3.6 $\mu_B$) and the saturation magnetization (1.2 $\mu_B$). The assumption of Guilland (Ref.6) on the presence of a ferromagnetic mechanism in MnP was not confirmed by the results of earlier investigations of the authors of this paper relating to the temperature dependence of the paramagnetic susceptibility and of the magnetocalorific effect. The theoretical calculation to be published by N. Guseynov and Ye. A. Turov (Izv. AN Azerb.SSR) confirms the assumptions of the authors of this paper of an "angular" distribution of the magnetic moments of adjacent atoms in MnP. The calculation leads to an angle between the vectors of the magnetic moments amounting to 165° which, however, has to be experimentally verified. The most reliable means of establishing the magnetic structure of MnP is by means of neutron diffraction. X-ray spectrum analysis of MnP would also be useful, since it would permit elucidating the electron states of the manganese atoms in this compound. Investigation of the susceptibility of the para-

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process in strong magnetic fields (about 100 kOe) and of the temperature dependence of the magnetization in the temperature range 77-4.2°K may prove an indirect but very important method of verifying the hypothesis on the magnetic structure of MnP. In the case of angular distribution of the magnetic moments, an increase in magnetization can be anticipated in strong magnetic fields (a gradual turning of the vectors of the magnetic moments into the direction of the field). The susceptibility should be a finite value at low temperatures and should not tend to zero at T → 0°K. The authors are investigating the magnetization of MnP in strong magnetic pulse fields. There are 1 figure and 7 references: 5 Soviet and 2 non-Soviet.
[Abstractor's Note: This is a slightly condensed translation.]

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AN SSSR)

SUBMITTED: July 4, 1960

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S/126/61/011/003/017/017
E032/E514

AUTHORS: Krasovskiy, V. P. and Fakidov, I. G.

TITLE: A Study of the Specific Heat of Manganese Monophosphide MnP

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.11, No.3, pp.477-479

TEXT: B. G. Whitmore (Ref.1) has established that manganese monophosphide has an anomaly in the specific heat curve at room temperatures. However, the method used by Whitmore is said to have been found insufficient to obtain accurate data on this anomaly. The present authors have investigated the anomaly using 99.99% pure manganese and 99.9% pure phosphorus. The compound MnP was obtained by heating a mixture of manganese and phosphorus in evacuated quartz containers to 650°C. The mixtures were kept at that temperature for 50 hours. The specific heat was measured with the aid of the vacuum calorimeter described by I. G. Fakidov and N. P. Grazhdankina (Ref.6). In order to improve the heat transfer, the calorimeter was filled with the powder and then hydrogen gas was introduced at a pressure of 50 mm Hg. The

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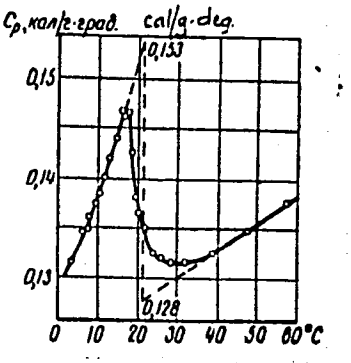
temperature was measured with a platinum resistance thermometer having $R_{100}/R_0 = 1.390$. A potentiometer, having a sensitivity of $3 \times 10^{-8}$ V/mm, was employed so that changes of the order of $10^{-5}$ ohm could be measured. This corresponded to a temperature change of $2.5 \times 10^{-3}$ deg. The heat dissipated in the thermometer was 0.0002 of the power produced by the heaters. The results obtained are shown in the figure, in which the specific heat is given in cal/g deg. As can be seen from the figure, the anomaly reaches a maximum at 17°C. The temperature corresponding to the maximum is very close to the Curie point of MnP (22°C). The latter was determined by the present authors using the magneto-caloric effect (Ref.2). This suggests that the observed specific heat anomaly is of a ferromagnetic nature. The magnitude of the anomaly shown by the dashed line turns out to be 2.15 cal/mol deg. The corresponding figure for $CrS_{1.17}$ was found in Ref.6 to be 2.58 cal/mol deg. The theoretical value obtained using measurements of the magneto-caloric effect (Ref.2) and the theory given by P. Weiss and R. Forrer (Ref.8) gives a figure of 10 R cal/mol deg.

On the other hand, the method of "thermodynamic coefficients" given by K. P. Belov in Ref.9 gives 0.2 R cal/mol deg. It is concluded that the energy of magnetic crystallographic anisotropy in MnP is relatively large and this may be responsible for the difference between the theoretical (thermodynamic) and the experimental results for the anomaly. There are 1 figure and 11 references: 7 Soviet and 4 non-Soviet.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals AS USSR)

SUBMITTED: October 4, 1960

Figure



24,2200 26567 S/126/61/012/002/019/019
18 7500 also 1160 1482 E073/E535

AUTHORS: Sadovskiy, V.D., Rodigin, N.M., Smirnov, L.V., Filonchik, G.M. and Fakidov, I.G.

TITLE: On the influence of a magnetic field on the martensitic transformations in steel

PERIODICAL: Fizika metallov i metallovedeniye, 1961, Vol.12, No.2, pp.302-304

TEXT: The authors investigated the effect of a magnetic field on martensitic transformations using specimens 3 mm dia., 50 mm long, of steel 9X2H (9Kh2N) (0.9% C, 1.83% Cr, 0.53% Ni, 0.27% Si, 0.30% Mn, 0.01% S, 0.018% P). These specimens were quenched from 850 and 1000°C in oil (so that they contained respectively 11 and 37% residual austenite) and were then subjected to a single magnetization by means of super-strong magnetic field pulses (200-350 kOe, 3000 c.p.s.). Magnetic measurements by a ballistic method did not show any increase in the martensite. Experiments at liquid nitrogen temperature also did not reveal a decrease [Abstractor's Note: Printing error for increase] in the quantity of residual austenite as a result of

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applying the magnetic field; only the usual increase in the quantity of martensite corresponding to deep cooling was observed. An increase in the number of magnetization cycles to five also had no influence on the results. Thus, it can be concluded that in the general case pulse magnetization even with very strong fields does not produce transformation of residual austenite in quenched steel. Further experiments were made with steel 50Kh23 (50KhN23) (0.52% C, 1.49% Cr, 22.85% Ni, 0.3% Si, 0.19% Mn, 0.068% P). Quenching of this steel from 1200°C yields a purely austenitic structure at room temperature. Martensitic transformation begins at about -100°C and at liquid nitrogen temperature the residual austenite amounts to 40-50%. Fifty pulse magnetization cycles (40-50 kOe) during cooling showed only a very slight effect on the quantity of martensite. Further experiments were carried out on the assumption that the martensitic point is lower for fine grained austenite than for coarse grained. Therefore, another series of experiments was carried out in which steel 50KhN23 was water quenched from 1200°C and cold rolled with a reduction of 60% and then again water quenched from 850, 900, 950 and 1000°C; this

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material was used for producing magnetometric specimens. At room temperature all the specimens had a purely austenitic structure but their grain size differed. Cooling in liquid nitrogen revealed that specimens quenched from 850, 900 and 950°C contained 1 to 3% martensite but the coarser grain specimens, which were originally quenched from 1000°C, contained 20 to 30% martensite after cooling in liquid nitrogen. However, pulse magnetization at liquid nitrogen temperature produced intensive austenite to martensite transformation even in the fine grained specimens quenched from 850 to 900°C. The increase in the number of magnetization cycles did not have a great influence. It is concluded that pulse magnetization can intensify austenite to martensite transformation. In the investigated case, the austenite was artificially stabilized by its fine grain size and is in a supermetastable state at the liquid nitrogen temperature, being undercooled considerably below its normal martensitic point. Activation of the transformation under the effect of a magnetic field is probably due to magnetostriction effects associated with the presence of a certain quantity of the magnetic phase. The problem

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E073/E535

requires further study. There are 3 figures and 6 references:
4 Soviet and 1 English which reads as follows: Metal treatment
and Drop Forging, 1960, 27, No.180, 362.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

SUBMITTED: May 22, 1961

Card 4/4

24.2200 1144
18.8100 1418 1413 4016

33451
S/126/61/012/006/005/023
E073/E535

AUTHORS: Zavadskiy, E.A. and Fakidov, I.G.

TITLE: Magnetization of the intermetallic compound $MnAu_2$ in super-high pulsed magnetic fields

PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.6, 1961, 832-837

TEXT: The measurements of A. J. Meyer and P. J. Taglang (Ref.2: J.Phys.Rad., 1956, 17, 457) revealed the existence of a threshold field and enabled investigation of the initial section of the approximation to saturation. By extrapolation, the saturation magnetization for several temperatures was calculated. Extrapolation to absolute zero enabled determining the magnetic moment per atom of manganese, which proved equal to 3.49 Bohr magnetons. Obviously these results are very approximate, since the ranges of the magnetic fields (up to 28 kOe) and temperatures were not wide enough. Therefore, the authors investigated the magnetization of a polycrystalline $MnAu_2$ specimen in the temperature range 77 to 418°K in pulsed magnetic fields of up to 300 kOe. At room temperature the field could be increased to

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Magnetization of the ...

500 kOe. The $MnAu_2$ compound was produced by fusing electrolytically purified manganese (99.98%) with 99.99% gold in an evacuated quartz ampoule at the temperature of 1100°C. The alloy was air-quenched and then annealed for two hours at 900°C followed by quenching in oil, annealing for 72 hours at 690°C followed by quenching in oil. After carrying out the magnetic measurements, the specimens 1.2 x 0.8 x 10 mm were again annealed at 690°C and the measurements were repeated. The reproducibility proved to be satisfactory. It was found from magnetization curves plotted on the basis of numerous oscillograms that these curves contained three characteristic sections at temperatures below the Neel point (368°K in the given case):

1. $H < 10$ kOe in which the susceptibility does not depend on the field strength and the alloy has an antiferromagnetic behaviour;
2. $H > 30$ kOe when the behaviour of the alloy is ferromagnetic;
3. Fields intermediate between the above two values in which the alloy has transient properties.

The investigated specimen had a density of 14.3 g/cm$^3$, the magnetic moment per manganese atom was 3.38 $\mu_B$, which is very near to the

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Magnetization of the ...

respective value in ferromagnetic alloys and also very near to the value of 3.49 $\mu_B$ obtained by Meyer and Taglang. The temperature dependence of the saturation magnetization can be expressed satisfactorily by the equation

$$I_{\infty,T} = I_{\infty,0}(1 - \beta T^2).$$

where $I_{\infty,0} = 595$ gauss and $\beta = 3.3 \cdot 10^{-6}$

Meyer and Taglang also determined the saturation magnetization and its temperature dependence in fields up to 28 kOe. They assumed that the approximation to saturation would obey the square value law in all field intensities. The measurements described in this paper showed that the square value law is complied with at fields up to 35-40 kOe at a temperature T = 290°K but only up to 37 kOe at T = 77°K. Extrapolated values of I, gauss vs. $1/H^2$ based on the square value approximation are considerably lower than those measured. The authors express the view that the behaviour in the paramagnetic range can be explained by introducing

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Magnetization of the . .

an "effective" field composed of the external and the molecular fields. The applied magnetic fields were not high enough for unequivocal solution of the problem of the influence of the temperature on the coefficient of the molecular field. The paramagnetic measurements in stronger fields will be continued for the purpose of elucidating the influence of temperature on the molecular field and the magnetic moment of saturation in the paramagnetic state. There are 5 figures and 8 references: 3 Soviet-bloc and 5 non-Soviet-bloc. The English-language references read as follows: Ref.2: quoted in text. Ref.3: Asch G. J. Phys. Rad., 1959, 20, 349.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

SUBMITTED: April 5, 1961

Card 4/4

89204
S/056/61/040/001/010/037
B102/B204

24.2200 (1137, 1142, 1158)

AUTHORS: Novogrudskiy, V. N., Fakidov, I. G.

TITLE: Temperature dependence of the Hall effect in $MnAu_2$

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 1, 1961, 76-78

TEXT: Of the many substances having various types of spin ordering, hitherto above all the magnetic properties of ferromagnetic substances have been studied. The authors now study the galvanometric properties of antiferromagnetics with a view of determining alone the fraction of the Hall effect which is immediately due to antiferromagnetism. $MnAu_2$ was selected as a specimen, an antiferromagnetic with threshold field effect (at field strength $H > H_{thr}$ it goes over into the ferromagnetic state). It was studied at the Neel temperature $T_N = 92°C$ and $H_{thr} = 8000$ oe. In an earlier paper it had already been shown that at $0 < H < H_{thr}$ the Hall emf depends linearly on H. Now, the temperature dependence of the Hall emf was determined on the same specimen. The curve obtained at H = 5000 oe is shown in a figure. The



3

Temperature dependence of ...

maximum is near the Neel temperature which had been determined from the temperature dependence of susceptibility. Here, $MnAu_2$ deviates essentially from magnesium telluride, which has a minimum of the Hall emf at Neel temperature. According to I. K. Kikoin, the Hall emf may be described by the equation $E_x = [R_0 H + R_1 \chi(H)] I/d = R_0 [1 + 4\pi\alpha\chi] HI/d$, a formula which holds for highly paramagnetic substances and ferromagnetics above Curie temperature. Here, I is the current in the sample, d - the thickness of the plate, $\chi$ the magnetic susceptibility, $R_0$ the Hall constant for the ordinary part of the effect, $R_1$ - the Hall constant for that part of the effect which is connected with magnetization. As $R_1$ is independent of temperature, the validity of this formula was taken over also for antiferromagnetics above Neel point. As may be seen from the figure, this is fully justified; in this connection,

$R_0 = -2.19 \cdot 10^{-12}$ v.cm.oe$^{-1}$a$^{-1}$, $R_1 = -2.42 \cdot 10^{-10}$ v.cm.a$^{-1}$.gauss$^{-1}$ and $\alpha = 8.8$ was determined. The $\alpha$ value is small compared to that of ferromagnetics. The high magnetic susceptibility ($\chi \approx 5 \cdot 10^{-3}$ cm$^{-3}$) leads to a considerable part of the Hall effect being due to magnetization in the paraprocess. As

Card 2/4
3

Temperature dependence of ...

is seen from the figure, the theoretical curve coincides with the experimental curve only at temperatures above Neel temperature, whilst below that point it deviates. Thus, this formula then does not describe the temperature dependence of the Hall emf in antiferromagnetics, when $R_0$ and $R_1$ are assumed to be temperature-independent. As $MnAu_2$ is a metal, and thus $R_0$ is not temperature-dependent, it is assumed that either $R_1$ or $\alpha$ depend on temperature. If $\alpha$ is $\sim 10^1$, a considerable part of the Hall effect due to magnetization may be found only in substances, in which $\gtrless 10^{-4}$ $cm^{-3}$ - thus not in MnTe. The anomaly of the Hall constant in MnTe near Neel point indicates the existence of an additional Hall emf due to antiferromagnetism. The mechanism of the production of this emf, however, is other than with $MnAu_2$. There are 1 figure and 7 references: 3 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Metal Physics of the Academy of Sciences USSR)

SUBMITTED: July 30, 1960

Card 3/4
3

ZAVADSKIY, Z.A.; KOVRIZHNYKH, Yu.T.; FAKIDOV, I.G.

Hall constant in p-Ge as a function of the magnetic field intensity.
Zhur. eksp. i teor. fiz. 40 no.4:1229-1231 Ap '61. (MIRA 14:7)

1. Institut fiziki metallov AN SSSR.
(Hall effect) (Germanium--Magnetic properties)

18.8100 1138, 1645, 1418
24,7900

24719
S/056/61/040/005/019/019
B109/B212

AUTHOR: Fakidow, I. G., Znamenskiy, B. V.

TITLE: Magnetic properties of the polycrystalline alloy Cu + 22.8 atom% Mn

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 40, no. 5, 1961, 1522 - 1523

TEXT: Measurements were done with an alloy consisting of Cu + 22.8 atom% Mn. The alloy had been obtained by h-f melting and had been subjected to a long tempering and subsequent hardening. It was found that the magnetic susceptibility of the alloy is independent of the field strength in fields up to 3000 oe and reaches a maximum at a temperature of 94° K. The magnetocaloric effect had a negative sign in the field range mentioned. The authors, therefore, came to the conclusion that the alloy is an antiferromagnetic material with a Neel point near 94° K. This antiferromagnetic material developed typical ferromagnetic properties at temperatures below $T_N$ when exposed to external field exceeding a critical value $H_p$. Measurements of the (now positive) magnetocaloric effect demonstrated the

Card 1/4

Magnetic properties of the ...

occurrence of a spontaneous magnetization. The magnetization reaches its saturation value in fields above 10.000 oe. The value of this critical field strength will change with varying temperature; e. g., at 56° K it amounts to 4000 oe. Above 94° K the alloy is paramagnetic for all values of the external field and it obeys the Weiß-Curie law. Results are shown in Figs. 1 and 2. It is noted that the alloy investigated resembles the well-known intermetallic compound $MnAu_2$ with respect to its magnetic properties; it is also pointed out that a neutron-diffraction study of the magnetic structure of the Cu-Mn alloy and a comparison with that of $MnAu_2$ (Ref. 9: A. Herpin, P. Meriel, Villain, C. R., Paris, 249, 1334, 1959) would be very valuable. The authors thank V. N. Novogrudskiy and E. A. Zavadskiy for discussions, and L. V. Smirnov for preparing the alloys. There are 2 figures and 9 non-Soviet-bloc references.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals, Academy of Sciences USSR). Sverdlovskiy gosudarstvennyy pedagogicheskiy institut (Sverdlovsk State Pedagogic Institute).

SUBMITTED: February 24, 1961

Card 2/4

35013
S/596/61/000/000/003/003
D217/D304

1.800

AUTHORS: Buzynov, A.Ye., and Fakidov, I.G.

TITLE: A few examples of the irradiation of steel articles with γ-rays from a betatron of 22 Mev

SOURCE: Akademiya nauk SSSR. Institut fiziki metallov. Betatronnaya gamma-defektoskopiya stali. Moscow, 1961, 40 - 41

TEXT: Five examples of radiographic betatron testing are described and it is concluded that defects in steel components of thickness 500 mm and above can be successfully detected at sufficiently high sensitivities of the order of 1 - 3 %. There are 6 figures and 3 non-Soviet-bloc references. The reference to the English-language publication reads as follows: N.C. Miller, and J.D. Seely, Non-destructive testing, 11, 1953, no. 8, 35.

Card 1/1

39658
S/137/62/000/007/061/072
A160/A101

9,6150
9,6000

AUTHORS: Samokhalov, A. A., Fakidov, I. G.

TITLE: The use of photocells in combination with phosphors for recording betatron, gamma and X-ray radiations

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 7, 1962, 81, abstract 7I543 (In collection: "Betatronnaya gamma-defektoskopiya stali". Moscow, AN SSSR, 1961, 52 - 55)

TEXT: The selenium ЛЭТИ (LETI)-type photocell and the vacuum phototube were used, in combination with phosphors as detectors of $\gamma$ -radiations, for recording the $\gamma$-radiation of a betatron (from 22 Mev to 0) and $Co^{60}$ isotope and the X-ray radiation. The current of the photocell was recorded with a galvanometer having a sensitivity of $5 \cdot 10^{-10}$ a/mm·m. Presented are data on the sensitivity to these radiations, arising in different combinations of the photocell with phosphors. The results of the experiments revealed that it is possible to build detectors for the $\gamma$ -radiation of betatron and $Co^{60}$ and the X-ray radiation when combining the photocell with various phosphors. Their sensitivity slightly depends on the hardness of the radiation, and equals $10^{-8}$ $\frac{a}{p/min}$ when using a ae-

Card 1/2

S/137/62/000/007/061/072
A160/A101

The use of photocells in combination with...

lenium photocell, and $10^{-10}$ $\frac{a}{p/min}$ when using a vacuum phototube. It is shown that the simple phosphor-photocell-galvanometer device may serve as a monitor for medium and highly-intensive radiations.

N. Kunina

[Abstracter's note: Complete translation]

Card 2/2

ZAVADSKIY, E.A.; FAKIDOV, I.G.

Conductance of germanium in high pulsed magnetic fields in the region of mixed conductivity. Fiz.tver.tela 4 no.7:1704-1709 Jl '62. (MIRA 16:6)

1. Institut fiziki metallov AN SSSR. Sverdlovsk.
(Germanium--Electric properties) (Magnetic fields)

43120
S/181/62/004/011/019/049
B104/B102

24.2200

AUTHORS: Levina, S. S., Novogrudskiy, V. N., and Fakidov, I. G.

TITLE: The magnetic properties of the intermetallic compound $Mn_5Ge_2$

PERIODICAL: Fizika tverdogo tela, v. 4, no. 11, 1962, 3185 - 3188

TEXT: The hysteresis loops and magnetization curves of polycrystalline samples of $Mn_5Ge_2$ prepared according to the method of K. Yasukōchi, K. Kanametsu and T. Ohoyama (J. Phys. Soc. Japan, 15, 932, 1960) were established using a torsion balance in vacuum. The compensation point, i.e., that temperature at which the magnetic moments of the sublattice balance themselves, was at 122°C. A metallographic investigation showed the presence of a eutectic of $Mn_5Ge_3$ + $Mn_{3.25}Ge$ on the boundaries of the large $Mn_5Ge_2$ crystals, the compound $Mn_{3.25}Ge$ being paramagnetic. Since this compound is present only in small quantities the magnetic properties of the base material are only slightly affected. At 18° the material has a coercive force of 1000 oersteds, at 200°C it has 3000 oersteds. In the region of the compensation point the coercive force is considerably increased. This behavior resembles that of lithium chromite ferrite

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Card 2/2

ZNAMENSKIY, B.V.; FAKIDOV, I.G.

Magnetization and the magnetocaloric effect of the Cu + 22.8 at o/o Mn polycrystalline alloy. Fiz. met. i metalloved. 13 no.2:312-314 F '62. (MIRA 15:3)

1. Institut fiziki metallov AN SSSR i Sverdlovskiy gosudarstvennyy pedagogicheskiy institut.
(Copper-manganese alloys--Magnetic properties)

S/126/62/013/005/026/031
E073/E435

AUTHORS: Levina, S.S., Novogrudskiy, V.N., Fakidov, I.G.

TITLE: Galvanomagnetic properties of the ferrimagnetic compound $Mn_5Ge_2$

PERIODICAL: Fizika metallov i metallovedeniye, v.13, no.5, 1962, 782-783

TEXT: The temperature dependence of the transverse galvanomagnetic effect of $Mn_5Ge_2$ was investigated using the same technology as that used by K. Yasukochi et al (J. Phys. Soc., Japan, 1960, 15, 932). The compensation temperature of the specimen was 130°C. The electric resistance was measured by means of compensation equipment, having a sensitivity of 2 x $10^{-8}$ volt/ scale division. Preliminary conclusions:
1. The temperature dependence of the electric conductivity of $Mn_5Ge_2$ is similar to that of metals.
2. According to a plot of the temperature dependence for an external field intensity of 16000 Oersted, the transverse galvanomagnetic effect changes in sign on passing through the compensation temperature in a like manner to the

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S/126/62/013/005/026/031
E073/E435

Galvanomagnetic properties ...

longitudinal effect in $Li_2O \cdot 2.5Fe_2O_3 \cdot 2.5Cr_2O_3$.

A change in the sign $\Delta R_\perp / R$ was observed in a substance containing other magneto-active ions and having a type of conductivity different from that of the ferrite (lithium chromite) used by Belov et al (ZhETF, 1960, 39, 1914). This permits assuming that the change in sign in a magnetic field in the neighbourhood of the compensation point is a characteristic property of a number of ferrimagnetics having such a point. There is 1 figure.

[Abstractor's note: Slightly abridged translation.]

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)

SUBMITTED: September 10, 1961

Card 2/2

ZNAMENSKIY, B.V.; FAKIDOV, I.G.

Electric resistance and its changes in the magnetic field of a polycrystalline alloy of Cu÷22.8 at. % Mn. Fiz. met. i metalloved. 13 no.5:784-785 My '62. (MIRA 15:6)

1. Institut fiziki metallov AN SSSR i Sverdlovskiy gosudarstvennyy pedagogicheskiy institut.
(Copper-manganese alloys--Electric properties)

41518
S/126/62/014/003/007/022
E039/E420

AUTHORS: Znamenskiy, B.V., Fakidov, I.G.

TITLE: Superparamagnetic properties of some antiferromagnetic alloys of the Cu-Mn system

PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.3, 1962, 391-395

TEXT: Previous work by the authors and other workers is extended. The magnetic properties of the polycrystalline alloy Cu + 22.8 at.% Mn are investigated in magnetic fields up to 200 k Oe and in the temperature range from 56 to 450°K. The method of preparation of the samples and the production of pulsed magnetic fields of 20 k Oe is as described in earlier papers. It is shown that in magnetic fields of up to 30 k Oe the approach to magnetic saturation follows the law

$$\sigma_{H,T} = \sigma_{\infty,T}\left(1 - \frac{A}{H^2}\right) \qquad (5)$$

where $\sigma$ is the magnetization and H the magnetizing field. For fields larger than 30 k Oe the square law begins to change and

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for fields above 75 k Oe the law of approach to saturation is

$$\sigma_{H,T} = \sigma_{\infty,T}\left(1 - \frac{B}{H}\right) \qquad (6)$$

The presence of ferromagnetic clusters in an antiferromagnetic matrix can lead to the appearance of terms of the form B/H in Eq.(6) which become dominant in very strong fields. No firm conclusion is drawn on the nature of the ferromagnetic clusters in the investigated alloys. Preliminary measurements on Cu-Mn alloys with an Mn content of 2.4, 5.3 and 7.5 at.% show that these alloys possess analogous magnetic properties. There are 6 figures.

ASSOCIATIONS: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals AS USSR)
Sverdlovskiy gosudarstvennyy pedinstitut
(Sverdlovsk State Pedagogical Institute)

SUBMITTED: March 26, 1962

Card 2/2

S/181/63/005/001/030/064
B102/B186

AUTHORS: Zavadskiy, E. A., Kovrizhnykh, Yu. T., and Fakidov, I. G.

TITLE: Negative photoconductivity of germanium in a magnetic field

PERIODICAL: Fizika tverdogo tela, v. 5, no. 1, 1963, 194 - 200

TEXT: The germanium photoconductivity was measured in the constant field of an electromagnet as well as in an alternating field with a damping decrement of 4.0 and a frequency of 3 kc. In order to avoid intense quantum effects of the carriers, measurements at 20°K were made in fields of up to 14 koe, at 77°K up to 60 koe and at room temperature up to 200 koe. The samples were illuminated by a single pulse from an ИФК-120 (IFK-120) gas-discharge lamp. Photoconductivity was measured as described by E. A. Zavadskiy and I. G. Fakidov (FTT, 4, 1704, 1962). With three n-type samples and one p-type the following characteristics were measured: $\Delta\sigma_H/\sigma_H = f(H)$ at 77°K and at $\varrho_T/\varrho_c$ = 18.3, 10.6 5.0 and 2.0; $\Delta\sigma_H/\sigma_H = f(\varrho_T/\varrho_c)$ at 20°K and at H = 0, 1.65, 3.5, 6.7, 12.4, and 14.4 koe;

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Negative photoconductivity ...

$\Delta\sigma_H/\sigma_H = f(1/H^2)$ at 77°K and at $\rho_T/\rho_c$ = 4.9, 1.25, 1.4 and 1.7; $(\Delta\sigma_H/\sigma_H)_\infty = f(\rho_T/\rho_c)$ at 77°K for an n-type and a p-type sample; $(\Delta p/n_o)_o = f(H^2)$ at 58 and 77°K. $\sigma_H$ denotes the conductivity without illumination, $\rho_T$ and $\rho_c$ are the resistivities without and with illumination at H = 0; $(\Delta\sigma_H/\sigma_H)_\infty$ gives the saturation value (extrapolated to H = $\infty$); $(\Delta p/n_o)_o$ gives the position of the injection level. The results, showing that at high magnetic field strengths the photoconductivity is negative, are in good quantitative agreement with theory (Madelung, Z. Naturf., 8a, 791, 1953). The results correspond to impurity conductivity. For samples with mixed dark conductivity, negative photoconductivity can be observed only at higher field strengths. There are 6 figures and 1 table.

ASSOCIATION: Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: July 26, 1962

Card 2/2

S/181/63/005/003/010/046
B102/B180

AUTHORS: Davidenko, N. I., and Fakidov, I. G.

TITLE: "Anomaly" of the longitudinal thermomagnetic Nernst-Ettingshausen effect

PERIODICAL: Fizika tverdogo tela, v. 5, no. 3, 1963, 769-772

TEXT: The authors review a number of Soviet papers, including their own (FTT 3, 1650 and 3198, 1960), dealing with thermomagnetic Nernst-Ettingshausen effects and their anomalies, i. e. deviations from the law $\ = -2/1$. Some new experiments are also described in brief. They were carried out at 124°K with artificial polycrystalline magnetite samples (1.5· 1.5·10 $mm^3$) in longitudinal and transverse fields of up to 15 koe. Both effects are found to be positive. There is 1 figure.

ASSOCIATION: Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: October 1, 1962

Card 1/2

S/181/63/005/004/008/047
B102/B186

AUTHORS: Rustamov, A. G., Samokhvalov, A. A., and Fakidov, I. G.

TITLE: Electrical properties of nickel-zinc ferrites

PERIODICAL: Fizika tverdogo tela, v. 5, no. 4, 1963, 1031 - 1039

TEXT: With the aim of explaining the electrical conduction mechanism, the electron energy spectrum and the interrelation between electrical and magnetic properties of complex 3d-oxides, the authors investigated conductivity, shf dielectric constants, thermo-emf, Hall effect, the magnetic field effect on the electrical resistance, the saturation magnetization and the paramagnetic susceptibilities of the ferrites $Ni_xZn_{1-x}Fe_2O_4 (0 \leqslant x \leqslant 1)$ as dependent on x and on temperature. The compositions were so chosen that the $Fe^{2+}$ ion concentration could be considered as constant ($2 \cdot 10^{20} cm^{-3}$). An analysis of the results and a comparison with corresponding results of other authors shows that several conduction mechanisms are possible for the groups of elementary and complex 3d-oxides. For Zn-ferrites with $ZnO:Fe_2O_3$ = 50 : 50 and similar compositions the $\mu_e(T)$ dependence indicates band

Card 1/2

S/181/63/005/004/008/047
B102/B186

Electrical properties of...

mechanism of conductivity and ferrites with high nickel concentrations up to nickel ferrite show a skip effect type mechanism. From Hall effect and resistivity measurements the electron concentration and the mobility was determined. The concentration was found to be between $10^{17}$ and $10^{19}$ $cm^{-3}$ and the mobility between $10^{-1}$ and $10^{-3}$ $cm^2/v \cdot sec$. There are 10figures and 4 tables.

ASSOCIATION: Institut fiziki metallov AN SSSR Sverdlovsk (Institute of the Physics of Metals AS USSR, Sverdlovsk)

SUBMITTED: October 19, 1962

Card 2/2

L 16903-63 EWG(k)/EWT(1)/EWP(q)/EWT(m)/BDS AFFTC/ASD Pz-4 AT/JD

ACCESSION NR: AP3005243 S/0056/63/045/002/0052/0055

66
65

AUTHOR: Levina, S. S.; Novogrudskiy, V. N.; Fakidov, I. G.

TITLE: Odd component of the galvanomagnetic effect in the ferrimagnetic compound $Mn_5Ge_2$.

SOURCE: Zhur. eksper. i teoret. fiz. v. 45, no. 2, 1963, 52-55

TOPIC TAGS: manganese germanium compound, ferrimagnetism, magnetoresistance, compensation point, antiferromagnetic vector

ABSTRACT: The magnetoresistance $\Delta R/R$ of the intermetallic compound $Mn_5Ge_2$ was investigated in longitudinal and transverse magnetic fields in order to check on the influence of prior application of a magnetic field to a ferrimagnetic material with a compensation point. Polycrystalline specimens were checked and the maximum field was 16000 Oe. The influence of the location of the potential electrodes with respect to the current electrodes on the measured effect was also checked and found to lie within the limits of the experimental error. The results of the test have shown that prior application of the field does affect the magnetoresistance, and most strongly near the compensation point. It is concluded at the same time that

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L 16903-63

ACCESSION NR: AP3005243

at temperatures far from the compensation point the application of the magnetic field gives rise to the odd component in the magnetoresistance of $Mn_5Ge_2$ in both transverse and longitudinal magnetic fields. The odd effect is linearly dependent on the field, and it is suggested that it is an odd function of the antiferromagnetic vector. Orig. art. has 3 figures and 1 table.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Metal Physics Institute, Acad. Sci. SSSR)

SUBMITTED: 16Feb63 DATE ACQ: 06Sep63 ENCL: 02

SUB CODE: PH NO REF SOV: 005 OTHER: 000

Card 2/2

ZAVADSKIY, E.A.; KOVRIZHNYKH , Yu.T.; FAKIDOV, I.G.

Photogalvanomagnetic effects in [illegible]manium in high magnetic fields. Fiz. tver. tela 6 no.1:173-181 [illegible] '64. (MIRA 17:2)

1. Institut fiziki metallov AN SSSR, Sverdlovsk i Sverdlovskiy gosudarstvennyy pedagogicheskiy institut.

ACCESSION NR: AP4029008 S/0126/64/017/003/0470/0471

AUTHOR: Novogrudskiy, V. N.; Fakidov, I. G.

TITLE: Temperature dependents of magnetic resistance in Mn $Au_3$

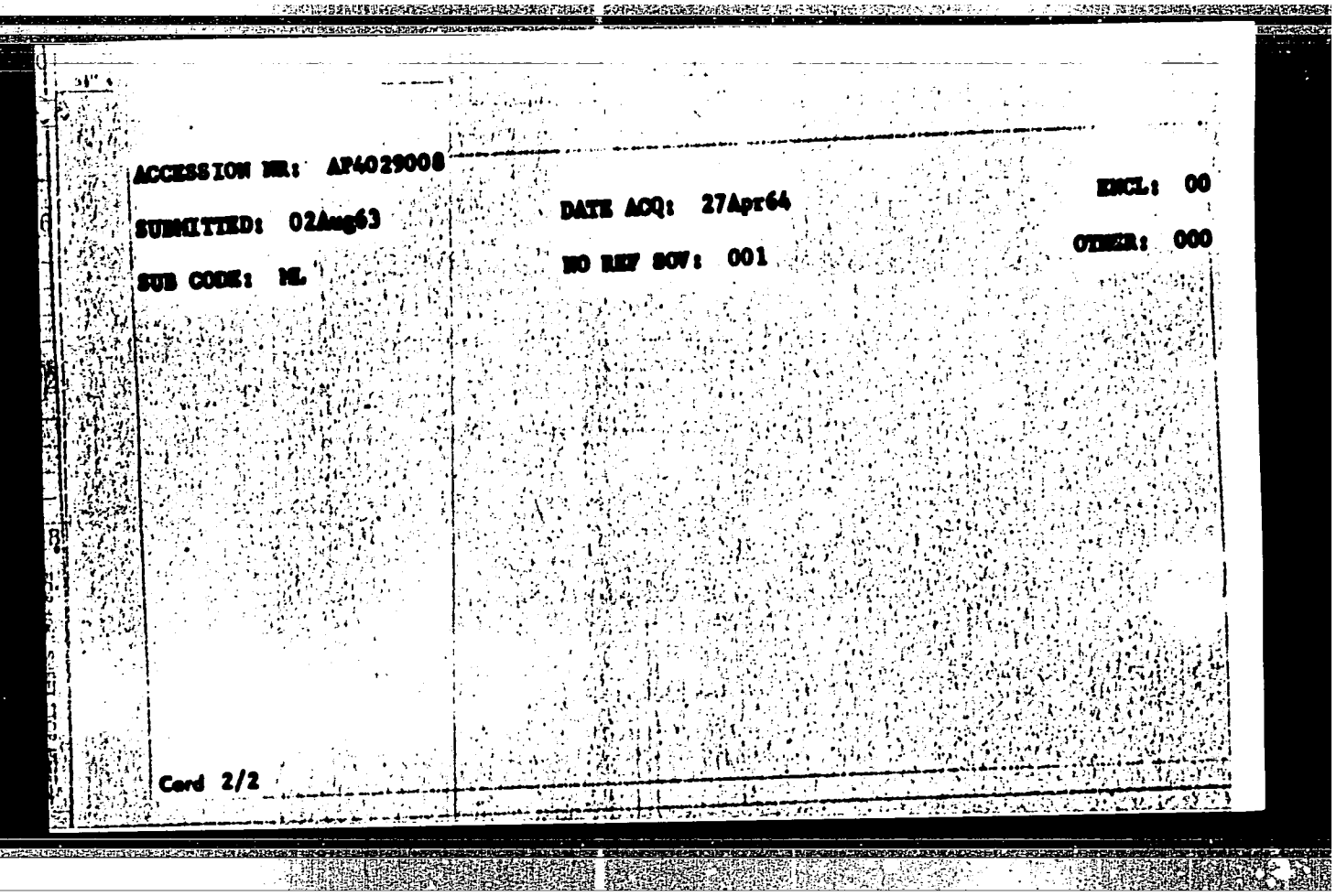
SOURCE: Fizika metallov i metallovedeniye, vol. 17, no. 3, 1964, 470-471

TOPIC TAGS: ferromagnetic, paramagnetic, spin order, antiferromagnetic compound, Neel temperature

ABSTRACT: In this paper the authors conduct a study of galvanomagnetic phenomena in the antiferromagnetic compound Mn $Au_3$. The Neel temperature of this substance equals -120°C. The $MnAu_3$ compound was prepared by alloying finely crushed manganese with gold flakes in a vacuum. The Neel point for the sample was -115°C. The temperature dependence of magnetic resistance is given in a figure. The magnetic resistance in $MnAu_3$ as well as in $MnAu_2$ has a component which is determined by the intensity of the magnetization, created by the external field. The temperature dependence measurement results of the changes in electrical resistance in the cross section magnetic field are given. Orig. art. has: 1 figure.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, AN SSSR)

Card 1/2



ACCESSION NR: AP4029008

SUBMITTED: 02Aug63 DATE ACQ: 27Apr64 ENCL: 00

SUB CODE: ML NO REF SOV: 001 OTHER: 000

Card 2/2

NOVOGRUDSKIY, V.N.; FAKIDOV, I.G.

Hall effect in a ferrimagnetic with a compensation point. Part 1. Experiment with $Mn_5Ge_2$. Zhur. eksp. i teor. fiz. 47 no.1:40-42 Jl '64. (MIRA 17:9)

1. Institut fiziki metallov AN SSSR.

L 10726-65 EWT(l)/EPA(s)-2 Pt-10 IJP(c)/AS(mp)-2/ASD(p)-3/RAEM(a)/S3D/ESD(t)/ESD(gs)/AFWL/ASD(a)-5 GG

ACCESSION NR: AP4046395 S/0056/64/047/003/0836/0839

AUTHORS: Zavadskiy, E. A.; Fakidov, I. G.; Samarin, N. Ya.

TITLE: Magnetic susceptibility of the antiferromagnets $MnSO_4$, MnO, and FeO in strong magnetic fields

SOURCE: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 47, no. 3, 1964, 836-839

TOPIC TAGS: antiferromagnetism, magnetic susceptibility, exchange interaction, manganese compound, iron oxide, magnetic field intensity

ABSTRACT: In order to check on the possibility that the exchange interactions in substances with a low Neel temperature can depend on the intensity of the magnetic field in sufficiently strong magnetic fields, the authors measured the susceptibilities of $MnSO_4 \cdot H_2$, MnO, and FeO in fields up to 300 kOe at temperatures both above and below the Neel temperature (100--400K). The measurements were made by

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L 10726-65

ACCESSION NR: AP4046395

4

slight modification of the method described by R. Stevenson (Rev. Sci. Instr. v. 32, 28, 1961) replacing the Gouy method used there by the Faraday method. A jump in susceptibility was observed in a certain range of magnetic fields both above and below the Neel temperature, and in the case of $MnSO_4.H_2O$ its temperature dependence was measured in the interval 100--400K. It is concluded on the basis of the experimental data that the exchange interactions occurring in antiferromagnets depend on the magnetic field. It is planned to confirm this hypothesis by studying antiferromagnets having a different ratio of molecular coefficients. "The authors are grateful to I. Ye. Dzyaloshinskiy, Ye. A. Turov, and B. V. Karpenko for useful discussions." Orig. art. has: 2 figures, 1 formula and 1 table.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute of Physics of Metals, Academy of Sciences SSSR)

Card 2/3

L 10726-65

ACCESSION NR: AP4046395

SUBMITTED: 02Apr64 ENCL: 00

SUB CODE: EM, SS NR REF SOV: 002 OTHER: 005

Card 3/3

L 52524-65 EWT(l)/EWT(m)/EWP(t)/EWP(b) IJP(c)---JD UR/0181/65/007/004/1095/1098

ACCESSION NR: AP5010717

23
21
B

AUTHOR: Novogrudskiy, V. N.; Fakidov, I. G.

TITLE: Galvanomagnetic properties of $MnAu_3$

SOURCE: Fizika tverdogo tela, v. 7, no. 4, 1965, 1095-1098

TOPIC TAGS: magnetoresistance, Hall effect, antiferromagnetism, magnesium compound, Neel temperature

ABSTRACT: The authors measured the magnetoresistance and the Hall effect in the antiferromagnetic compound $MnAu_3$, prepared by fusing manganese powder and platelets of gold in an evacuated quartz ampoule. The Hall emf and the magnetoresistance were measured with a dc potentiometer and a galvanometer. To eliminate extraneous effects, the measurements were made in two directions of the magnetic field and of the current in the sample. The temperature was maintained constant with a cryostat described elsewhere (FMM v. 8, 694, 1959). Measurements of the maximum susceptibility and of the kink in the electric-resistivity curve yielded a value -114C for the Neel temperature. A sharp minimum in the magnetoresistance was observed at this temperature, and a secondary kink has shown that no second-

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L 52524-65

ACCESSION NR: AP5010717

2

order phase transition takes place at -114C. An analysis of the magnetoresistance dynamics shows that below the Neel temperature the magnetoresistance is connected with a change in the antiferromagnetic order upon application of a magnetic field. The Hall emf was found to be linear in the temperature both above and below the Neel point. The experimental data indicate conclusively that the Hall emf depends on the degree of antiferromagnetic ordering, and suggst that the Hall effect is determined by the external field. "The authors thank L. G. Gaydukov for help with the measurements. Orig. art. has: 4 figures and 3 formulas.

ASSOCIATION: Institut fiziki metallov AN SSSR, Sverdlovsk (Institute of Metal Physics, AN SSSR)

SUBMITTED: 090ct64 ENCL: 00 SUB CODE: SS, EM

NR REF SOV: 002 OTHER: 002

Card 2/2

L 9245-66 EWT(l)/EWT(m)/EWP(t)/EWP(b) IJP(c) JD/GG

ACC NR: AP5022744 SOURCE CODE: UR/0181/65/007/009/2863/2865

44,55 44,55 44,55 44,55

AUTHOR: Novogrudskiy, V. N.; Fakidov, I. G.; Semenov, V. V.

ORG: Institute of Physics of Metals AN SSSR, Sverdlovsk (Institut fiziki metallov AN SSSR)

TITLE: Magnetic properties of $Mn_3Ge_2$

SOURCE: Fizika tverdogo tela, v. 7, no. 9, 1965, 2863-2865

21,44,55

TOPIC TAGS: manganese compound, germanium compound, phase transition, magnetic property, ferromagnetic material, magnetic anisotropy

21,44,55

ABSTRACT: Previous studies have shown that the compound $Mn_3Ge_2$ undergoes a first order phase transition at -120°C and that the compound is a weakly ferromagnetic material above this point. The present paper is an attempt to determine whether magnetic ordering takes place below the transition point. A magnetic balance was used to measure the intensity of magnetization in the longitudinal and transverse directions on grain-oriented specimens. Curves are given for magnetization as a function of field strength at various temperatures and for magnetic susceptibility as a function of temperature in both the longitudinal and transverse directions. Magnetic susceptibility decreases with an increase in temperature above -120°C and the susceptibility is very nearly equal in both directions independently of the field strength. This is

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L 9245-66

ACC NR: AP5022744

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one of the most characteristic properties of weak ferromagnetic materials. The authors are grateful to B. S. Borisov for taking the x-ray photographs. Orig. art. has: 3 figures, 2 formulas.

SUB CODE: 20/ SUBM DATE: 16Apr65/ ORIG REF: 004/ OTH REF: 001

Card 2/2

L 11145-66 EWT(1)/EWT(m)/EWP(t)/EWP(b) IJP(c) JD

ACC NR: AP6000858 SOURCE CODE: UR/0181/65/007/012/3582/3587

AUTHORS: Kovrizhnykh, Yu. T.; Fakidov, I. G.

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TITLE: Galvanomagnetic effects in semiconductors with nonequilibrium impurity distribution

SOURCE: Fizika tverdogo tela, v. 7, no. 12, 1965, 3582-3587

TOPIC TAGS: galvanomagnetic effect, magnetoresistance, germanium, impurity conductivity

ABSTRACT: To study magnetoresistance anisotropy, the authors measured the magnetoresistance of germanium in a strong magnetic field capable of distorting the carrier distribution in the semiconductor, and observed the presence of an additional voltage on the potential contacts. This voltage was proportional to the current and to the magnetic field intensity. To display the potential difference resulting from the gradient of the impurity concentration, the concentration of the sam-

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ple was altered by doping in only a part of the sample. Half a single crystal of germanium with carrier density $n = 10 \times 10^{14}$ $cm^{-3}$ was doped in antimony vapor to a depth ~ 0.1 mm on each side (the sample thickness was 0.5 mm). Measurements of the voltage distribution along the sample showed an abrupt variation of the resistance from 46 to 0.02 ohm-cm. The results agreed equally with the hypothesis that the uneven distribution of the impurities bring about the potential difference. Measurement of the angular dependence of the change in voltage showed that the presence of impurity concentration gradients causes annular equalization currents to flow in the sample when it is placed in a magnetic field. These currents produce an additional voltage on the potential contacts. The magnitude of the additional component of the voltage on the potential contacts is determined by the impurity concentration gradient in the sample and can serve as a criterion for the concentration inhomogeneity in the sample. In the impurity concentration region, this additional voltage is proportional to the magnetic field intensity, to the current in the sample, and to the width of the sample. In the region of mixed conductivity, the relation between the voltage and the magnetic field intensity becomes

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ACC NR: AP6000858

nonlinear in strong magnetic fields. To eliminate possible errors, the ratio of the length to the width of the sample must be increased and the values obtained for different polarities of the magnetic field must be averaged. Orig. art. has: 8 figures and 1 formula.

SUB CODE: 20/ SUBM DATE: 14Jun65/ OTH REF: 004

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Card 3/3

L 60440-65 EWT(m)/EWA(d)/T/EWP(t)/EWP(z)/EWP(b)/EWA(c) MJW/JD/JW

ACCESSION NR: AP5016527 UR/0126/65/019/006/0852/0857

AUTHOR: Fakidov, I. G.; Voronchikhin, L. D.; Zavadskiy, E. A.; Burkhanov, A. M. 38 35

TITLE: Variation in magnetization of austenitic steel in a strong pulsed magnetic field 19

SOURCE: Fizika metallov i metallovedeniye, v. 19, no. 6, 1965, 852-857

TOPIC TAGS: austenitic steel, martensitic transformation, magnetic phenomenon, metal physics, thermodynamic analysis, low temperatur phenomenon

ABSTRACT: Magnetization of austenitic steels 50Kh2N22, 50KhN23 and 40Kh2N20 was studied. The martensitic transformation took place under the action of a strong magnetic field. The dependence of magnetization of the steels on the value of the magnetic field impulse was measured at 77°K, as well as the dependence of the critical field $H_k$, for which the γ-α transformation occurs, on the temperature (77-300°K) and the duration of the impulse. The relationship for the critical field on frequency was given by $H_k=55+5f^{0.25}$, and the validity of the relation $\partial T/\partial H=\sigma/(S_2-S_1)$=constant was established, where σ-magnetization of the sample to one gauss; $S_1$ and $S_2$-

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